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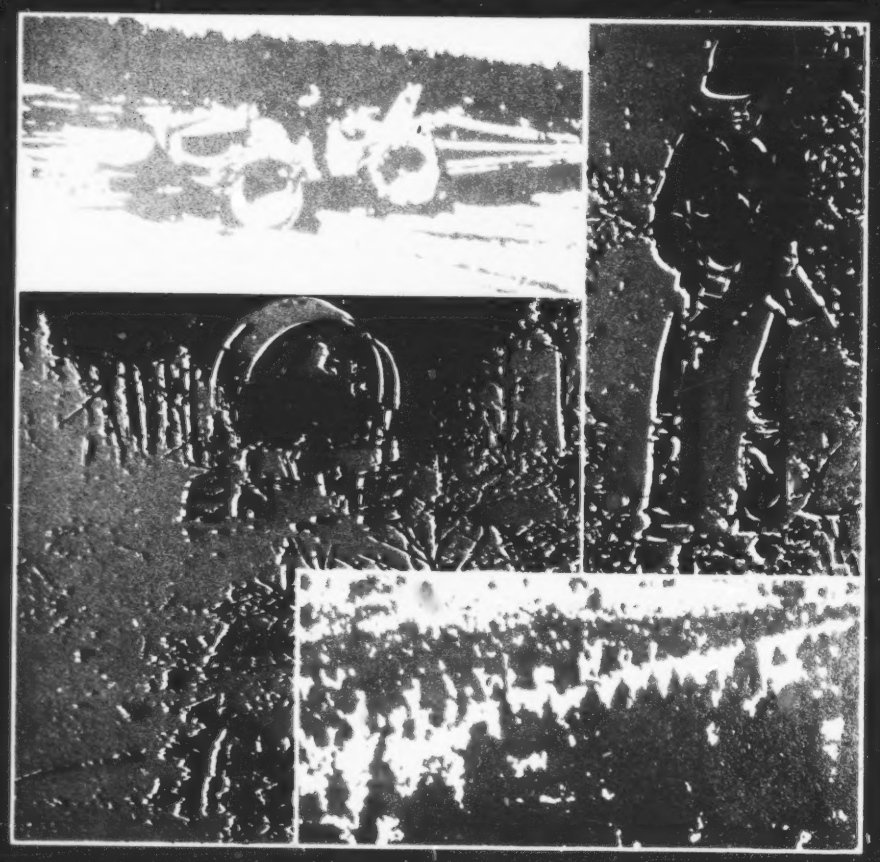
# Reporting and Summarizing Forestry Change Data Manitoba Pilot Study

Forestry Statistics and Systems Branch
Canadian Forestry Service

Information Report PI-X-36



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# Reporting and Summarizing Forestry Change Data Manitoba Pilot Study

*Forestry*
*Statistics & Systems*
*Branch*

*Petawawa National*
*Forestry Institute*

*Chalk River, Ontario*

*1984*

Information Report PI-X-36

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Catalogue No. Fo46-11/361984E
ISSN 0706-1854
ISBN 0-662-13216-5

Additional copies of this publication can be obtained from:
Forestry Statistics and Systems Branch
Petawawa National Forestry Institute
Environment Canada
Canadian Forestry Service
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Cette publication est aussi disponible en français sous le titre Présentation des données sur les changements touchant les forêts — Étude pilote au Manitoba

## Acknowledgements

This report was prepared by Brian D. Haddon of the Forestry Statistics and Systems Branch (FSSB).

The pilot project was undertaken by the Change Data Program with the assistance of the Systems Development Program, FSSB.

The Forestry Statistics and Systems Branch thank R. Lamont, D. Rannard, and their staff at the Manitoba Department of Natural Resources for contributing time and resources to this pilot study, and especially for providing the data from which this report is produced.

## Introduction

Canadians expect their forests to provide recreational opportunities and aesthetically pleasing backdrops, as well as timber and fiber. As a result, our forests are continuously being subjected to forces of man and nature which change their size, distribution, and type. It is clear that forestry in Canada is undergoing many changes and facing new pressures. Policies and programs are evolving rapidly to meet this reality. Governments and industry are working to intensify forest management and there is increasing awareness of the need for information on the forest resource, its productive potential, and dynamics.

Periodic and quantitative information describing forest resource dynamics has been termed "change data". We have applied the term to include:

**1.** Depletions to the forest, such as forest area and wood volume removed by harvesting, wildfires, and insect and disease damage;

**2.** Accruals, such as area and volume gained from forest growth;

**3.** Management activities undertaken to protect or enhance the resource, such as silvicultural treatments; and,

**4.** Changes in land ownership and status that affect the utilization of the resource.

A more extensive list of forest change activities is presented in Appendix 1.

Foresters need detailed change data to manage their forests. Senior managers need summarized change data for policy decisions and program justification.

The present report demonstrates the use of the computer-based Canadian Forest Resource Data System (CFRDS) for reporting and summarizing change data needed for policy decisions and program justification. The pilot study was conducted in Manitoba, but the system should be applicable across the country.

## Background

The Manitoba Department of Natural Resources currently collects change data through two programs. The Regional Services Branch, through the Forest Protection — Damage and Loss Program, produces Wildfire Reports. The Reports are based on fire data sent in by departmental field officers from within their districts. The fires are plotted onto inventory maps and areas determined from these maps.

Volume loss figures are obtained by combining data from Wildfire Reports with the Inventory Section's volume per hectare master file. The link is the stand number within each map sheet (township). Volumes are computed on the Manitoba Data Services (MDS) mainframe computer. Summary reports of area burned, volume loss, and costs are produced and sent to the regional and head offices.

The Manitoba Forestry Branch initiated the Forest Management Area Change Program in 1978. Through this program, regional forestry officers provide information on depletions other than fires, and on forest management activities. Regeneration surveys are run from the Forestry Branch Headquarters and it is intended that data from them will be incorporated. Provision is made to change ownership and status records and to correct inventory records in which errors have been detected.

The change data originates at the regional (field) office where the change activity is delineated on a forest inventory map. The area is calculated manually using either a dot grid or a planimeter and this information, along with other reference data, is written out on coding forms (Figure 1). These forms are sent to the head office for key-punching and entry into the MDS computer. The depletion areas are not linked to the inventory to obtain volume depletions as is done with the Wildfire Reports. Summaries were not returned to the regional offices at the time of the project, although this practice is expected to commence in the fall of 1983. At present, the regional offices keep copies of coding forms as their records.

*Figure 1.*

***Forest Management Area Change Record Sheet***

## Data Treatment

### Summarization

The 1981 - 1982 Forest Management Area Change Program records were extracted from the MDS computer. These covered the period April 1, 1981 to March 31, 1982. Forestry Statistics and Systems Branch staff visited the regional and head offices of the Forestry Branch to validate and complete the data. A computer program was written by the Manitoba Forestry Branch to combine Forest Management Area Change Program data with inventory data for the calculation of volume depletions. Similar to the program used to calculate volume lost to fires, this program used the stand number to link the area of change to volume in inventory.

The Canadian Forest Resource Data System (CFRDS) was used in creating a change data file. This computer-based system was used to establish the national forest inventory data base and has been described by Bonnor (1982). The 1981-1982 area and volume data from the Wildfire Reports were extracted from the MDS computer and merged with the 1981-1982 data from the Forest Management Area Change Program to create the change data file. As with the national inventory data base, the summary unit or "cell" is the map sheet, referenced in Manitoba by meridian, township, and range.

Change activities were grouped in broader categories where appropriate for the production of summary maps and tables. The maps are simple choropleth maps, which is to say that they were produced from data summarized by cells, and symbolize the magnitudes of the data as they occur within the boundaries of the cells. Cell boundaries along with major geographic and jurisdictional boundaries were first digitized, i.e. their coordinates were calculated and stored in the computer. The change data, stored by cell, and the digitized boundaries were transmitted to a plotter which produced the maps.

### Presentation

Summaries were produced from the data file in tabular and graphical form. Figure 2 shows the change activities measured and recorded in Manitoba in 1981-1982 and their relative magnitudes. The area of forest land in Manitoba is 23 975 000 ha, of which 13 937 000 ha are productive forest land (Bonnor 1982). About 1.8% of the productive forest land area (237 000 ha) was affected by reported change.

The tables, maps, and charts presented in this report as examples of CFRDS products were designed to be complementary. Available data can be summarized and presented in tables or charts to facilitate communication and comprehension. Maps allow communication of spatial relationships and place the data into geographic context. Two types of depletion activities and two types of silvicultural treatments are described in Figures 3-6.

A summary of occurrence and magnitude of change activities in the various Forest Sections is presented in Figure 7. The tables, maps, and charts are presented together in this report as an "Atlas Of Manitoba Forestry Change Data, 1981-1982".

## Discussion

To be useful, information must be readily available and in a form which is easily assimilated. This project demonstrated that location-specific change data can be summarized and presented in tabular and graphical form with relative ease and rapidity. All the change data reported in Manitoba in 1981-1982 were location-specific and could therefore be handled by the CFRDS data base management system. It was possible, then, to directly relate change data to other data (specifically, inventory data) already in the CFRDS data base.

The CFRDS permits summarization of change data at any level from the basic unit, the township in Manitoba, to regional through national levels. Geographic referencing in this pilot project was limited to the township map sheet; however, if a subdivided township grid was available it could have been used for more detailed summarization to better suit regional needs. In Manitoba, sections or quarter sections could serve as geographically referenced cells.

Although losses to insects and disease were not reported, these activities are location-specific and could be handled by CFRDS. Other location-specific change activities such as land use changes, changes in land status, changes in ownership resulting in the removal of forest land for harvesting purposes, and the accrual of wood volume due to growth could also be summarized and presented using CFRDS.

The project involved working with data that had been recorded by a variety of individuals in a number of locations. It has highlighted the need for the development and adoption of standardized terms and definitions. Appendix 2 is included as a basis for discussion and resolution of this problem.

Inter- and intra-agency communications were identified as problem areas. These are institutional as well as technical in nature. The forest is affected by nonforestry activities, meaning that information on many activities will be reported, if at all, by nonforestry agencies. Communication with these agencies must be established.

*Figure 2.*

## *Forestry Change in Manitoba, 1981-1982*

**About 60% of Manitoba's forest land is classified as productive. Reported change affected about 1.8% of the province's productive forest land in 1981-1982. Fire was by far the largest reported change activity, the area burned being almost 13 times greater than the area of all other changes.**

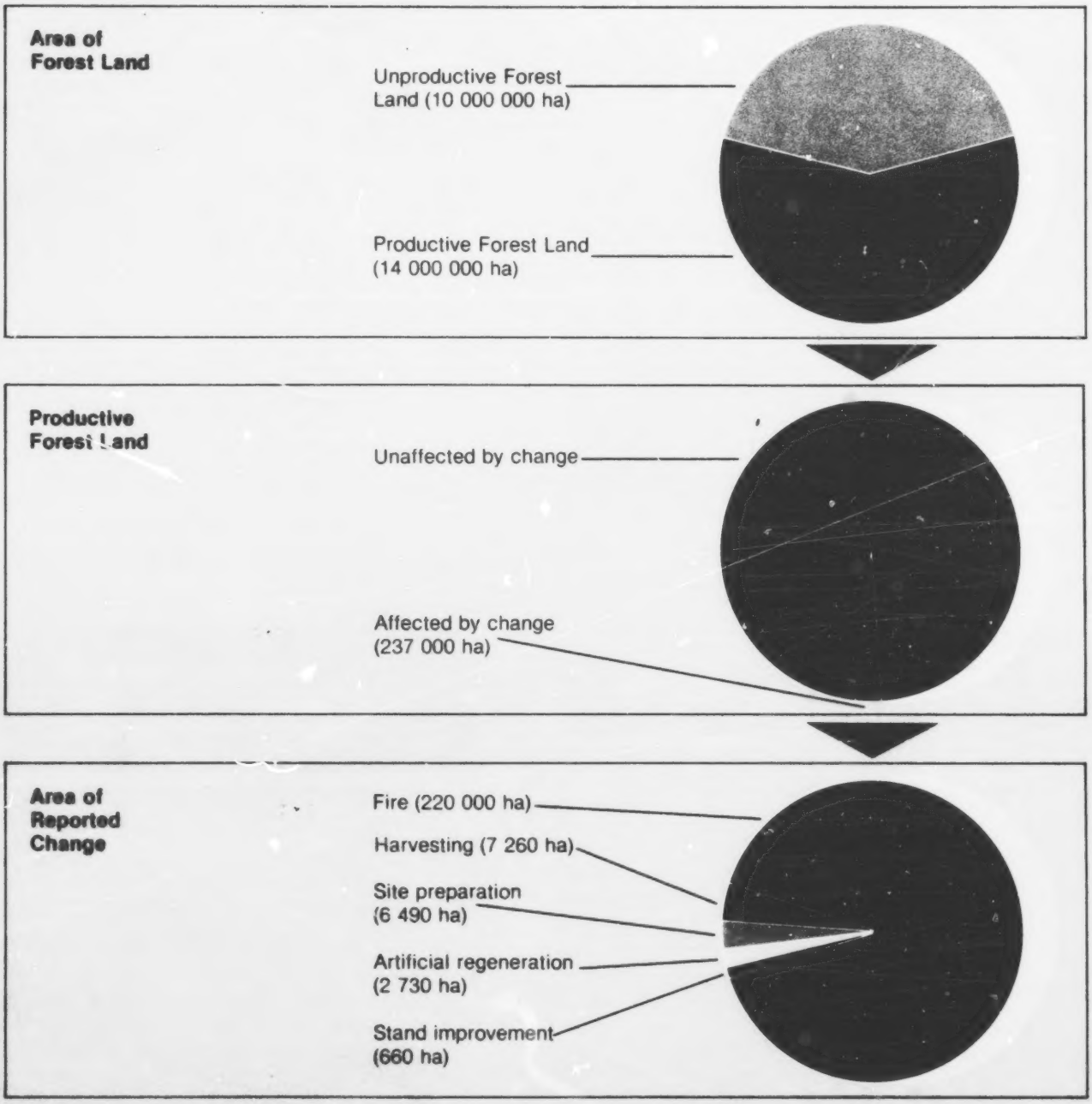

Area of Forest Land
Unproductive Forest Land (10 000 000 ha)
Productive Forest Land (14 000 000 ha)
Productive Forest Land
Unaffected by change
Affected by change (237 000 ha)
Area of Reported Change
Fire (220 000 ha)
Harvesting (7 260 ha)
Site preparation (6 490 ha)
Artificial regeneration (2 730 ha)
Stand improvement (660 ha)

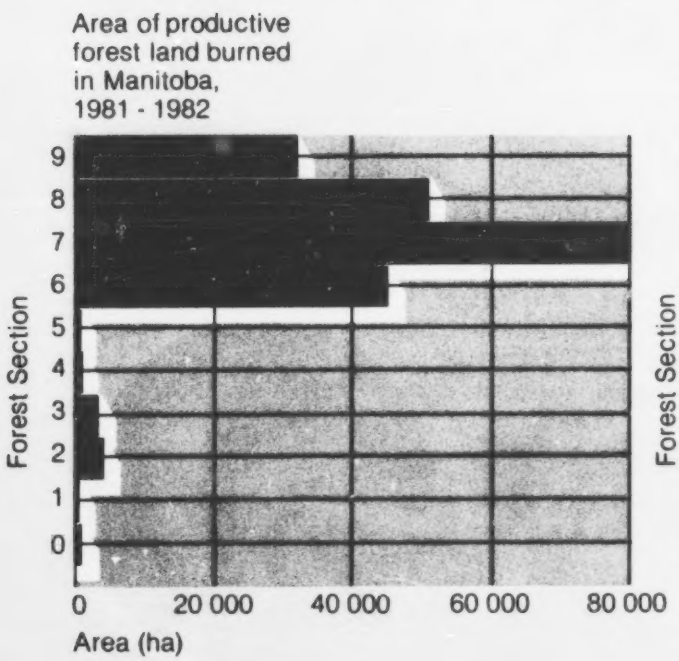
*Figure 3.*

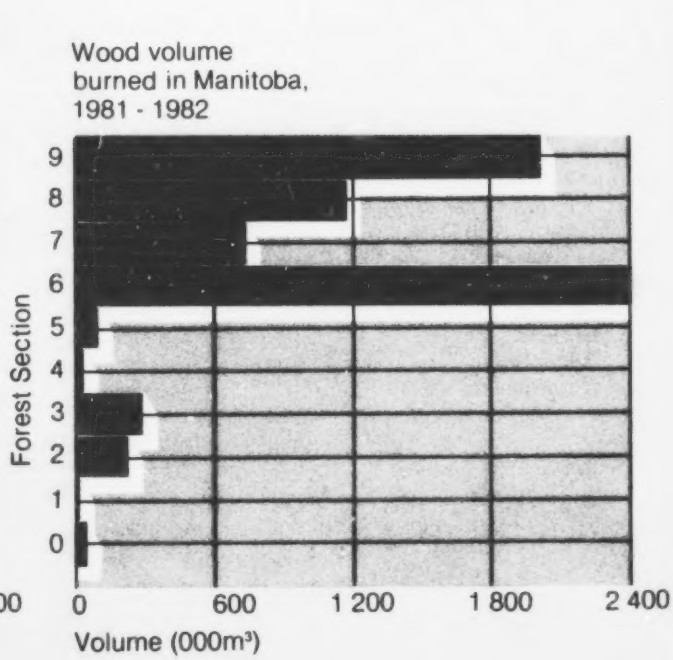
## *Depletion by Wildfire in Manitoba, 1981 - 1982*

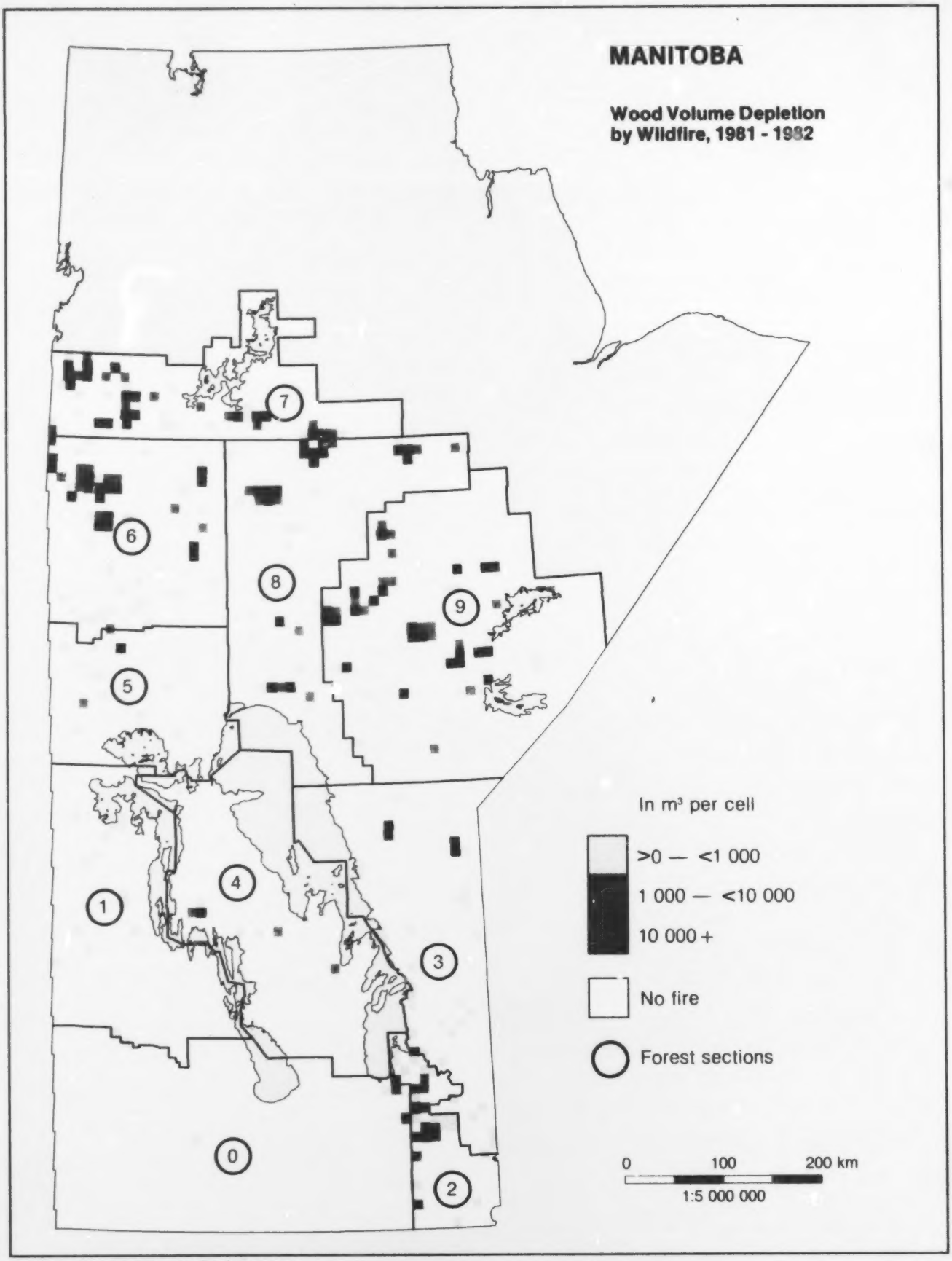
**The 1981 fire season in the northern part of the province was the worst experienced in recent years. Forest Section 7 suffered the largest area burned, but because of its low productivity (volume per hectare), the volume loss there was not as high as elsewhere. The largest loss of wood volume occurred in Forest Section 6.**

| *Forest Section* | *Area of Productive Forest Land** | *Area Burned* | *Volume on Productive Forest Land** | *Volume Burned*** |
|---|---|---|---|---|
| | (1 000 ha) | | (1 000 000 m³) | |
| 0 Aspen Parkland | 281 | 0.8 | 14.0 | 0.032 |
| 1 Mountain | 1 159 | 0.1 | 82.0 | 0.004 |
| 2 Pineland | 581 | 3.9 | 30.8 | 0.221 |
| 3 Lake Winnipeg East | 1 924 | 3.4 | 105.9 | 0.282 |
| 4 Interlake | 1 201 | 2.0 | 51.6 | 0.025 |
| 5 Saskatchewan River | 834 | 1.0 | 43.9 | 0.076 |
| 6 Highrock | 1897 | 45.5 | 101.0 | 2.422 |
| 7 Churchill River | 1 669 | 80.2 | 16.1 | 0.701 |
| 8 Nelson River | 1 953 | 50.9 | 85.4 | 1.158 |
| 9 Hayes River | 2 438 | 32.3 | 111.7 | 2.024 |
| Total | 13 937 | 220.3 | 642.4 | 6.945 |

*Source: Canada's Forest Inventory 1981
**Assuming total depletion on areas burned
Note: Totals may not add due to rounding






Produced for the Forestry Statistics and Systems Branch, Canadian Forestry Service by the Geocartographics Sub-Division, Statistics Canada, 1984.

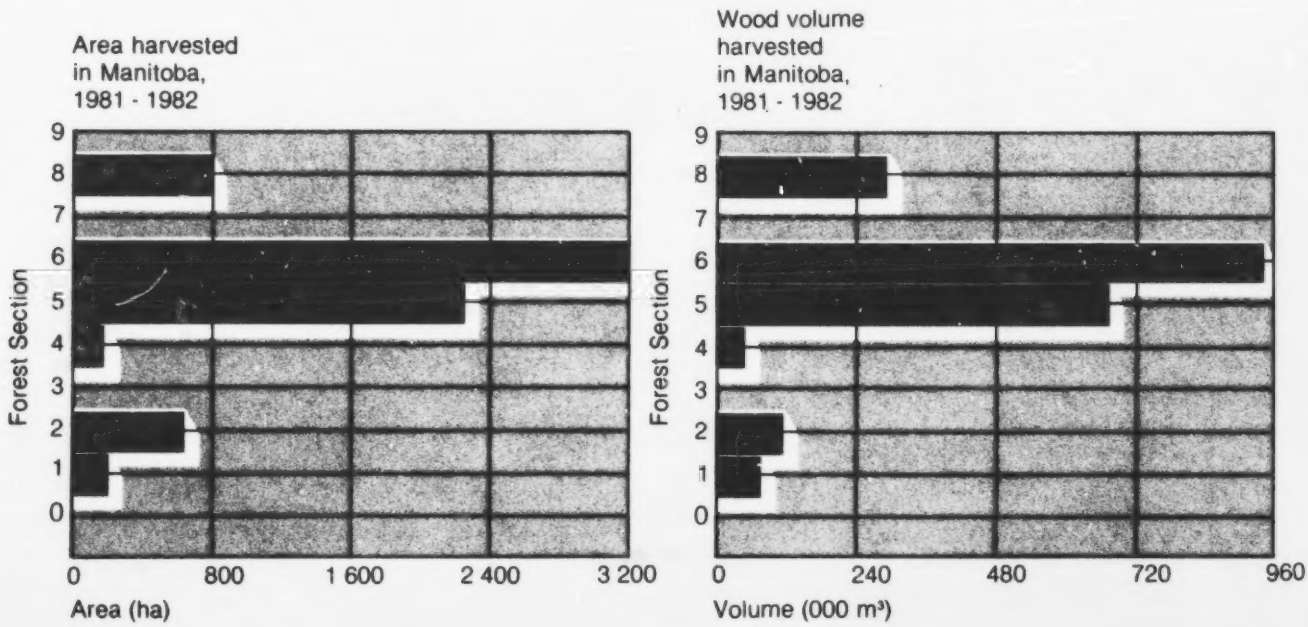
*Figure 4.*

## *Harvesting in Manitoba, 1981 - 1982*

**Reported harvesting activity was concentrated around the Manitoba Forestry Resources Ltd. complex at The Pas.**

| *Forest Section* | *Area of Productive Forest Land** | *Area Harvested* | *Volume on Productive Forest Land** | *Volume Harvested*** |
|---|---|---|---|---|
| | (1 000 ha) | | (1 000 000 m³) | |
| 0 Aspen Parkland | 281 | 0.0 | 14.0 | 0.000 |
| 1 Mountain | 1 159 | 0.2 | 82.0 | 0.076 |
| 2 Pineland | 581 | 0.6 | 30.8 | 0.130 |
| 3 Lake Winnipeg East | 1 924 | 0.0 | 105.9 | 0.000 |
| 4 Interlake | 1 201 | 0.2 | 51.6 | 0.050 |
| 5 Saskatchewan River | 834 | 2.3 | 43.9 | 0.679 |
| 6 Highrock | 1 897 | 3.2 | 101.0 | 0.943 |
| 7 Churchill River | 1 669 | 0.0 | 16.1 | 0.000 |
| 8 Nelson River | 1 953 | 0.8 | 85.4 | 0.255 |
| 9 Hayes River | 2 438 | 0.0 | 111.7 | 0.000 |
| Total | 13 937 | 7.3 | 642.4 | 2.133 |

*Source: Canada's Forest Inventory 1981
**Assuming total depletion on areas harvested
Note: Totals may not add due to rounding



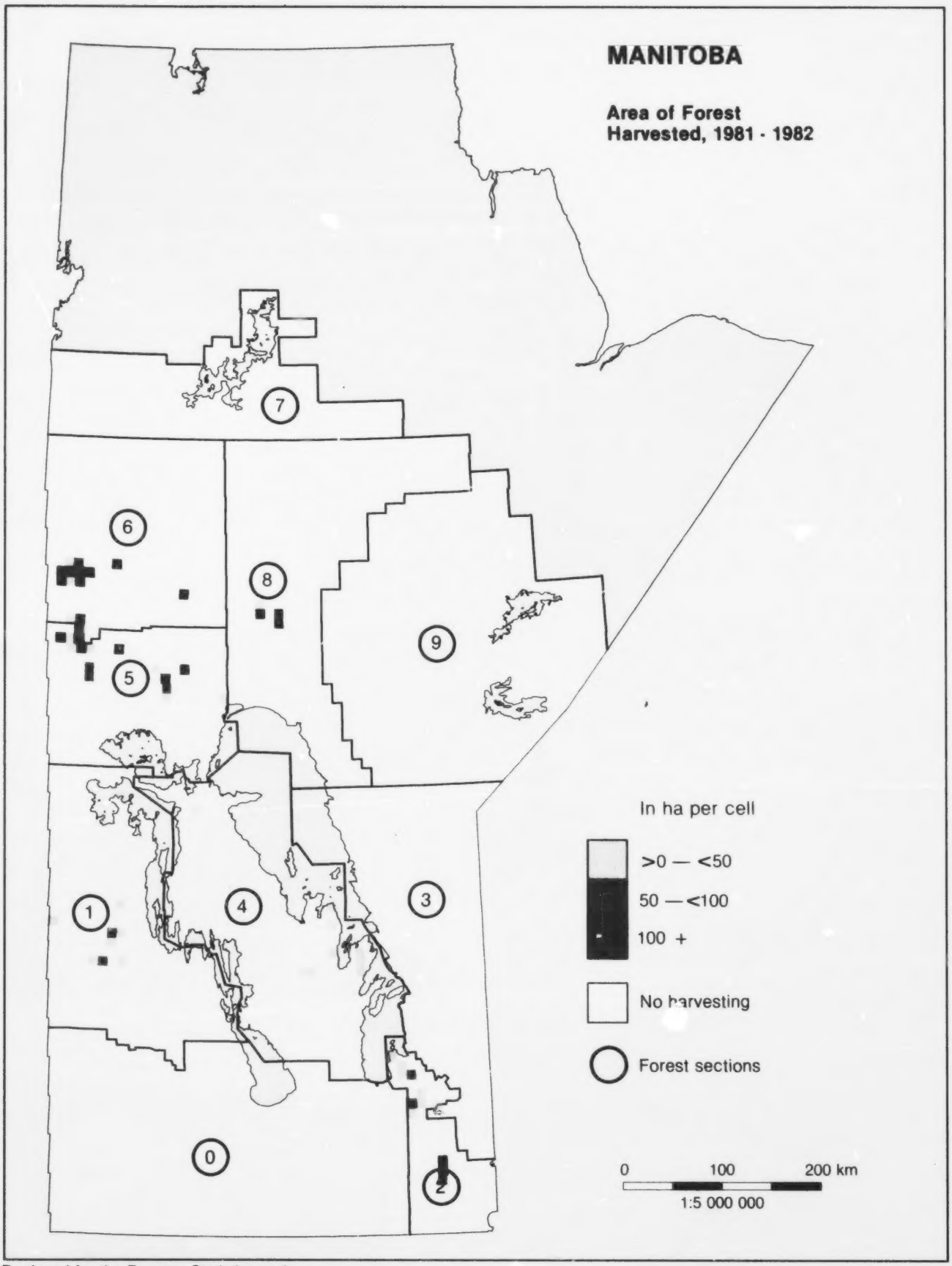



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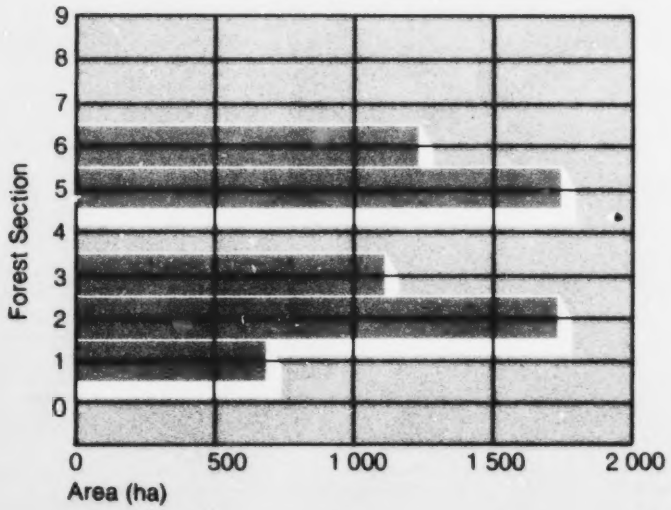
*Figure 5.*

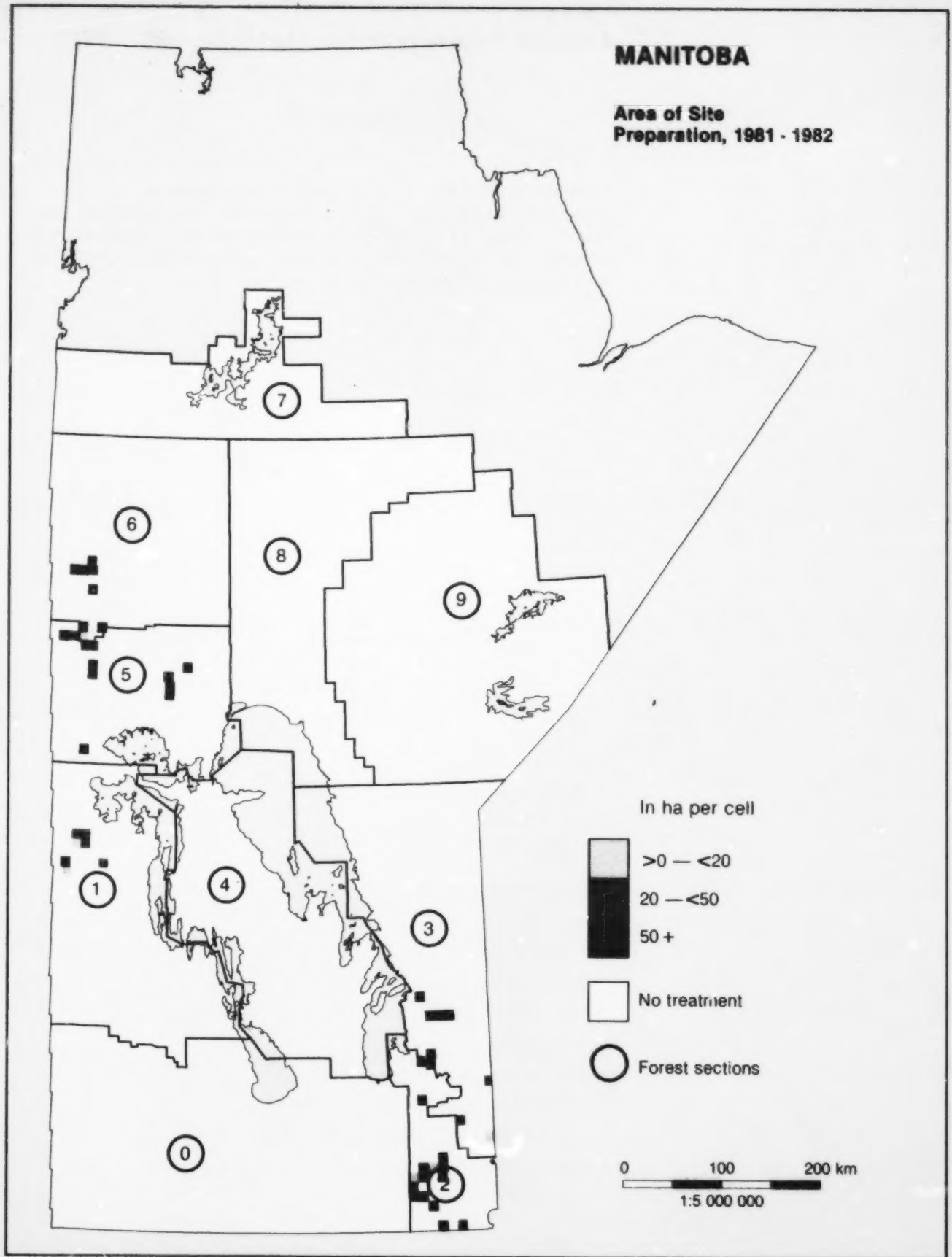
## *Site Preparation in Manitoba, 1981 - 1982*

**Site preparation work was concentrated in those parts of the province where forestry is of greatest economic importance.**

| *Forest Section* | *Productive Forest Land** | *Site Preparation* |
|---|---|---|
| | (Area in ha) | |
| 0 Aspen Parkland | 281 000 | 0 |
| 1 Mountain | 1 159 000 | 664 |
| 2 Pineland | 581 000 | 1 748 |
| 3 Lake Winnipeg East | 1 924 000 | 1 105 |
| 4 Inter'ake | 1 201 000 | 0 |
| 5 Saskatchewan River | 834 000 | 1 746 |
| 6 Highrock | 1 897 000 | 1 227 |
| 7 Churchill River | 1 669 000 | 0 |
| 8 Nelson River | 1 953 000 | 0 |
| 9 Hayes River | 2 438 000 | 0 |
| Total | 13 937 000 | 6 490 |

*Source. Canada's Forest Inventory 1981
Note: Totals may not add due to rounding






Produced for the Forestry Statistics and Systems Branch, Canadian Forestry Service by the Geocartographics Sub-Division, Statistics Canada, 1984.

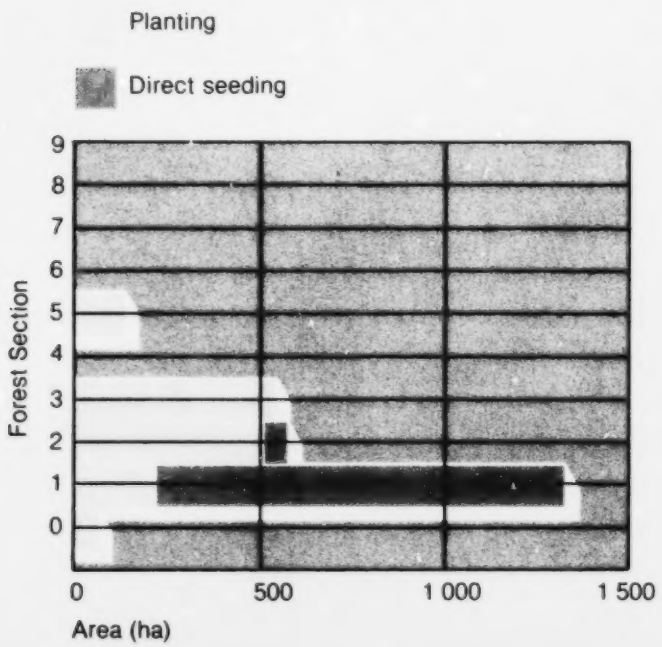
*Figure 6.*

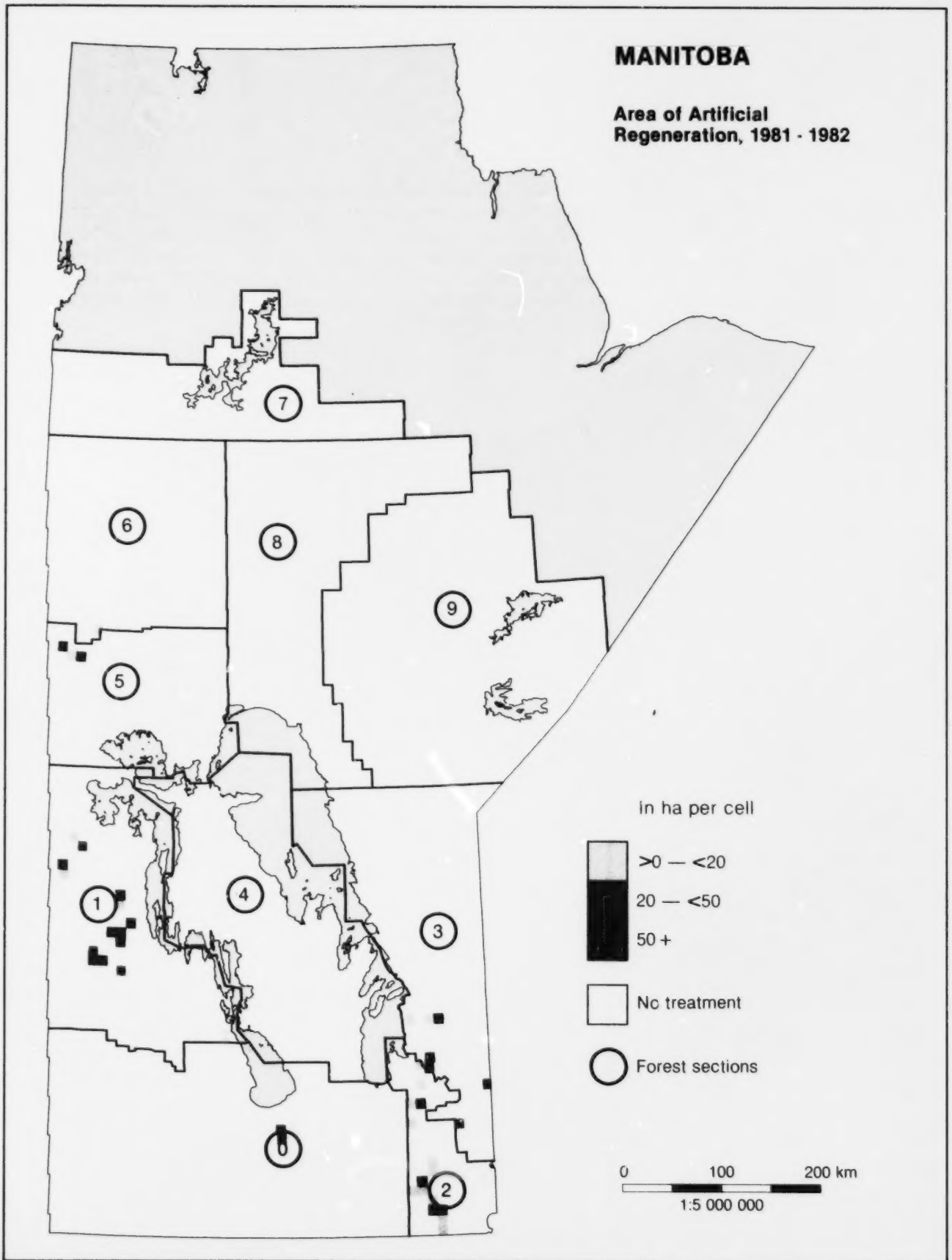
## *Artificial Regeneration in Manitoba, 1981 - 1982*

**Planting was the preferred method of artificial regeneration in most parts of the province. However, the area of direct seeding was four and one half times that of planting in Forest Section 1, where the greatest artificial regeneration effort was recorded.**

| *Forest Section* | *Productive Forest Land** | *Planting* | *Direct Seeding* | *Total* |
|---|---|---|---|---|
| | | *Area in ha* | | |
| 0 Aspen Parkland | 281 000 | 74 | 0 | 74 |
| 1 Mountain | 1 159 000 | 243 | 1 094 | 1 337 |
| 2 Pineland | 581 000 | 517 | 82 | 599 |
| 3 Lake Winnipeg East | 1 924 400 | 565 | 0 | 565 |
| 4 Interlake | 1 201 000 | 0 | 0 | 0 |
| 5 Saskatchewan River | 834 000 | 155 | 0 | 155 |
| 6 Highrock | 1 897 000 | 2 | 0 | 2 |
| 7 Churchill River | 1 669 000 | 0 | 0 | 0 |
| 8 Nelson River | 1 953 000 | 0 | 0 | 0 |
| 9 Hayes River | 2 438 000 | 0 | 0 | 0 |
| Total | 13 937 000 | 1 556 | 1 176 | 2 732 |

*Source: Canada's Forest Inventory 1981
Note: Totals may not add due to rounding



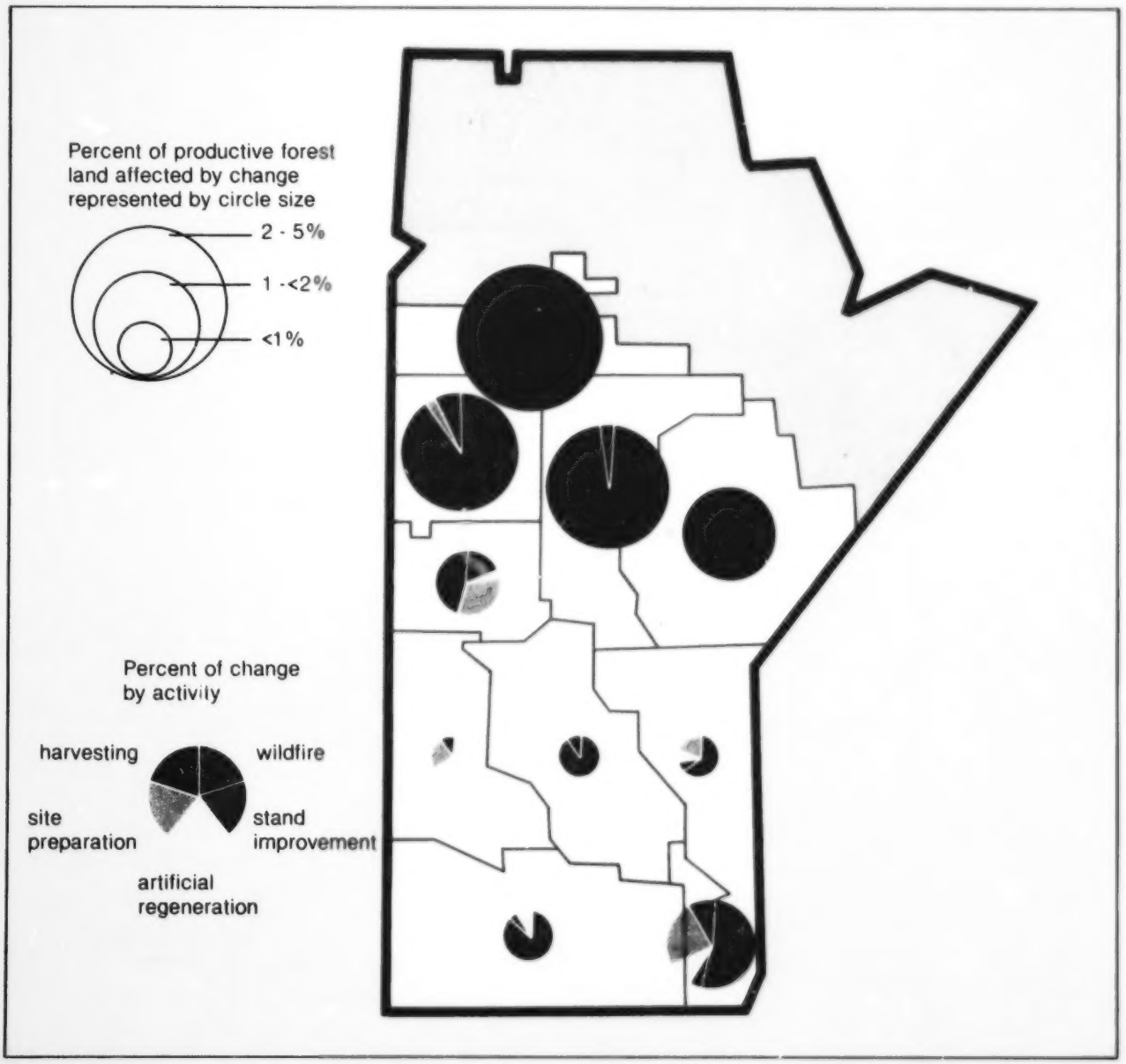



Produced for the Forestry Statistics and Systems Branch, Canadian Forestry Service by the Geocartographics Sub-Division, Statistics Canada, 1984.

*Figure 7.*

***Area of Change Activities in Manitoba, 1981-1982***

**The amber, yellow and magenta segments in this figure represent forest renewal efforts. The green segments, depicting area harvested, indicate the economic importance of forestry in each Forest Section. The red segments represent the area of loss to wildfire. A much larger area of productive forest land was burned than harvested in every part of the province except the west-central.**



## Literature Cited

Bonnor, G.M. 1982. Canada's forest inventory 1981. Environ. Can., Can. For. Serv., For. Stat. Syst. Branch, Chalk River, Ontario.

*Appendix 1.*

## ■ *Forest change activity list*

**Depletions**

| | |
|---|---|
| ***Harvest cuttings*** | — land area by cutting method<br>— gross merchantable wood volume removed by primary forest product. |
| ***Fire damage*** | — numbers of fires by cause and size<br>— land area burned<br>— gross merchantable wood volume destroyed. |
| ***Insect damage*** | — land area affected by infestation, by insect species.<br>— gross merchantable wood volume destroyed by insect species. |
| ***Disease damage*** | — land area affected by epidemic, by disease agency<br>— gross merchantable wood volume destroyed by disease agency. |
| ***Other pest damage*** | — land area affected by animal agent, such as beaver flooding<br>— gross merchantable wood volume destroyed by agent. |
| ***Weather damage*** | — land area affected by type of weather damage<br>— gross merchantable wood volume destroyed by type of damage. |
| ***Damage by other natural catastrophe*** | — land area affected by other natural catastrophes such as land slides<br>— gross merchantable wood volume destroyed by type of catastrophe. |
| ***Other man-caused damage*** | — land area affected by cause, which does not result in a withdrawal from forest land use<br>— gross merchantable wood volume destroyed by cause. |

**Accruals**

| | |
|---|---|
| ***Forest growth*** | — gross merchantable annual volume increase due to growth. |

| Treatments | |
|---|---|
| ***Site preparation*** | — land area treated by clearing, prescribed burning, scarification or herbicides. |
| ***Direct seeding*** | — land area artificially seeded by species and method. |
| ***Planting*** | — land area planted by species and number of seedlings. |
| ***Tending*** | — land area by treatment (e.g. weeding, cleaning, thinning, pruning, and sanitation measures). |
| ***Fertilizing*** | — land area fertilized by type and amount. |
| ***Pest/pathogen control*** | — land area treated by control method. |
| ***Commercial thinnings*** | — land area cut over by method<br>— gross merchantable wood volume removed. |
| ***Salvage cuttings*** | — land area cut over by method<br>— scaled wood volume removed. |

| Land status and ownership changes | |
|---|---|
| ***Withdrawals/ additions*** | — land area and gross merchantable wood volume withdrawn from or added to nonreserved forest land use. |
| ***Other status and ownership changes*** | — land area and gross merchantable wood volume affected under a status or ownership change which may not result in a total addition or withdrawal from nonreserved forest land use. |

| Assessments | |
|---|---|
| ***Forest renewal*** | — land area affected by natural and artificial regeneration success or failure as determined by an assessment or survey |

*Appendix 2.*

## ■ *Definitions of change data terms*

Uniformity of terminology and its usage will reduce possibilities of misunderstanding when reporting national change data. It is hoped that the following terminology will gain national acceptance. The source of each definition is indicated where appropriate. An asterisk indicates an amendment; two asterisks denote a new definition.

***Additions:*** Areas added to the productive forest land base.**

***Bare-root planting:*** Setting out young trees with their roots freed from the soil in which they had developed (Ford-Robertson 1971).*

***Broadcast seeding:*** The sowing of seeds more or less evenly over a whole area on which a forest stand is to be raised (Ford-Robertson 1971).*

***Cleaning:*** A cultural operation eliminating or suppressing undesirable vegetation, mainly woody (including climbers), during the sapling stage of a forest crop. It has to be done before or, at the latest, concurrent with the first thinning, so as to favour the better trees; may include unwanted crop species as well as intrusive vegetation (Ford-Robertson 1971).*

***Clear-cutting:*** The felling of all trees on a tract of forest land.**

***Container planting:*** Setting out young trees from, or together with, receptacles containing the soil, etc. in which they have developed, either from seed or as transplants (Ford-Robertson 1971).

***Direct seeding:*** The artificial sowing of seeds in an area by manual or mechanical means (Brace and Golec 1981).

***Disease:*** Harmful deviation from normal functioning of physiological processes, generally pathogenic or environmental in origin (Ford-Robertson 1971).*

***Drill seeding:*** The sowing of seeds in shallow furrows across a whole area on which a forest stand is to be raised. **

***Fertilizing:*** The addition of nutrients to the soil in organic or inorganic form (Brace and Golec 1982).

***Fire hazard reduction:*** Any treatment of fuels that reduces the threat of ignition and spread of fire (Ford-Robertson 1971).

***Fungicide:*** Any agent used to kill or inhibit the growth of fungi and their spores.**

***Harvest cutting:*** The cutting of economically or biologically mature trees or stands as final crops forming the final yield at the end of a rotation in the case of even-aged silvicultural systems and as periodic crops in the case of uneven-aged silvicultural systems (Bowen et al 1981)*

***Herbicide:*** Any chemical preparation used to kill or inhibit the growth of forbs, grasses, woody plants, and their seeds (Brace and Golec 1982).

***Immature:*** In even-aged management, those trees or stands that have grown past the regeneration stage, but are not sufficiently developed to be harvestable (except for thinning operations) (Bonnor 1978).

***Increment:*** The increase in diameter, basal area, height, volume, quality or value of individual trees or stands during a given period (Bonnor 1978).

***Insecticide:*** Any chemical or biological preparation used to kill or disrupt the development of insects. **

***Merchantable:*** Of a tree or stand that has attained sufficient size, quality and/or volume to make it suitable for harvesting. Does not imply accessibility, economic or otherwise (Bonnor 1978).

***Not satisfactorily restocked land (NSR):*** Forest land capable of producing forest crops which, because of harvest cutting, fire, insect attack, wind or other disturbance, does not presently support a forest stand that meets minimum stocking standards.**

***Partial cutting - High-grading:*** A type of harvest cutting that removes only certain species above a certain size or of high value. Known silvicultural requirements and/or sustained yields being wholly or largely ignored or found impossible to fulfil (Ford-Robertson 1971).*

***...ial cutting - Seed-tree:*** An even-aged ...ltural system in which an area is cut clear ... for certain trees called seed trees. These ... standing singly or in groups to furnish seed ...ral restocking of the cleared area (Bowen ... 91).*

***Part... ...tting - Selection:*** An uneven-aged silvicultu... system in which trees are removed individual... or in small groups continuously at relatively s...ort intervals. By this means there is constant renewal of a forest crop.**

***Partial cutting - Shelterwood:*** Any harvest cutting of a more or less regular and mature crop, designed to establish a new crop under the protection (overhead or side) of the old (Ford-Robertson 1971).*

***Pathogen:*** A microscopic organism or virus directly capable of causing disease (Ford-Robertson 1971)*.

***Pest:*** An organism, particularly an insect or mammal (capable of) causing damage (Ford-Robertson 1971).*

***Pest control measures:*** The destruction of habitat or application of pesticide to eliminate or control pest populations.**

***Planting:*** Establishing a forest by setting out seedlings, transplants, or cuttings in an area (Ford-Robertson 1971).*

***Prescribed burning:*** Controlled application of fire to wildland fuels in either their natural or modified state. Weather conditions, fuel moisture, soil moisture, etc. should be such that fire is confined to a predetermined area and at the same time produce the intensity of heat and rate of spread required to further certain planned objectives of silviculture, wildlife management, grazing, fire-hazard reduction, etc. (Ford-Robertson 1971).*

***Productive forest land:*** Forest land that is capable of producing a merchantable stand within a reasonable length of time (Bonnor 1978).

***Pruning:*** The removal, close to or flush with the stem, or side branches, live or dead, and of multiple leaders from a standing tree for the improvement of the tree or its timber (Ford-Robertson 1971).*

***Refilling:*** Restocking failed areas in a crop or stand by further sowings or plantings (Ford-Robertson 1971).

***Regeneration:*** The renewal of a forest crop by natural or artificial means. This term also applies to the crop so obtained. (The new crop is generally less than one metre in height) (Bonnor 1978).*

***Salvage cuttings:*** Cuttings made primarily to remove trees that have been or are in imminent danger of being killed or damaged by injurious agencies other than competition between trees (Bowen et al 1981).*

***Sanitation measures:*** The removal of (i) dead, damaged, or susceptible trees or their parts, or (ii) other vegetation that serves as alternate host for crop tree pathogens, essentially to prevent or control the spread of pests or pathogens.**

***Sapling:*** A young tree having a diameter at breast height greater than 1 cm but less than the smallest merchantable diameter (Bonnor 1978).

***Seedling:*** A young tree having a diameter at breast height equal to or less than 1 cm. Includes trees with a height less than 1.30 m (Bonnor 1978).

***Silvicultural system:*** A planned program of silvicultural treatment during the whole life of a stand, including steps taken as means of controlling the establishment, composition, construction and growth (Bowen et al 1981).*

***Site preparation:*** Disturbance of an area's topsoil and ground vegetation to create conditions suitable for regeneration.**

***Spot seeding:*** The sowing of seeds within small, cultivated, or otherwise prepared patches, many of which are distributed over a whole area on which a forest stand is to be raised. **

***Stand:*** A community of trees possessing sufficient uniformity in composition, age, arrangement or condition as to be distinguishable from the forest or other growth on adjoining area, thus forming a silvicultural or management entity (Bonnor 1978).

***Stocking:*** A qualitative expression of the adequacy of tree cover on an area in terms of crown closure, number of trees, basal area or volume, to a preestablished norm. In this context "tree cover" includes seedlings and saplings, hence the concept carries no connotation of a particular age (Bonnor 1978).

***Sustained yield:*** The yield that a forest can produce continuously at a given intensity of management (Ford-Robertson 1971).

***Tending:*** Generally, any operation carried out for the benefit of a forest crop or an individual thereof at any stage of its life; covers operations on the crop itself and on competing vegetation, but not harvest cutting or site preparation (Ford-Robertson).*

***Thinning:*** A cutting made in an immature crop or stand in order primarily to accelerate diameter increment but, also, by suitable selection, to improve the average form of the trees that remain (Ford-Robertson 1971).*

***Thinning - Commercial:*** Any type of thinning producing merchantable material at least to the value of the direct costs of harvesting (Ford-Robertson 1971).

***Thinning-Precommercial:*** Any type of thinning which does not produce merchantable material of value at least equal to the direct costs of the operation.**

***Weeding:*** Generally, a cultural operation eliminating or suppressing undesirable vegetation, mainly herbaceous; during the seedling stage of a forest crop and therefore before the first cleaning, so as to reduce competition with the seedling stand (Ford-Robertson 1971).

***Wild land:*** Uncultivated land other than fallow (Ford-Robertson 1971).

***Withdrawals:*** Areas removed from the forest land base.**

## *Sources*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